REMARKS

In the Office Action, claims 1-9 and 11-17 were rejected. Claim 18 was allowed. All of claims 1-9 and 11-18 are believed to be in condition for allowance. Reconsideration and allowance of all pending claims are requested.

Rejections Under 35 U.S.C. § 103

Claims 1-9 and 11-17 are rejected under 35 U.S.C. §103(a) as being unpatentable over Corsmeier et al., (U.S. Patent No. 5,049,033, hereinafter Corsmeier) in view of Prowse et al., (U.S. Patent 6,626,635, hereinafter Prowse), Haddad et al. (U.S. Patent No. 4,999,991 hereinafter Haddad) and West (U.S. Patent 3,227,418).

Claim 1 recites a system for controlling blade tip clearance in a turbine. The system includes a stator including a shroud having a plurality of shroud segments, a rotor including a blade rotatable within the shroud and an actuator assembly positioned radially around the shroud. The actuator assembly includes a plurality of actuators. The system also includes a sensor for sensing a turbine parameter and generating a sensor signal representative of the turbine parameter, a modeling module generating a tip clearance prediction in response to turbine cycle parameters. A controller receives the sensor signal and the tip clearance prediction and generates at least one command signal. The actuators include at least one actuator receiving the command signal and adjusting a position of at least one of the shroud segments in response to the command signal.

The Examiner's position is believed to be as follows. The Examiner argued that Corsmeier discloses a system for controlling blade tip clearance in a turbine that includes a stator including a shroud having a plurality of shroud segments, a rotor including a blade rotatable within the shroud and a controller receiving the sensor signal and the tip clearance prediction and generating at least one command signal. Further, the Examiner argued that the system also includes actuators, including at least one actuator receiving the command signal and adjusting a position of at least one of the shroud segments in

response to the command signal. The Examiner cited the passages at col. 5, lines 28-61, col. 7, lines 38-50 and col. 8 lines 36-41 of Corsmeier in support of the rejection.

However, the Examiner acknowledged that Corsmeier fails to disclose an actuator assembly positioned radially around the shroud, an actuator assembly including a plurality of actuators, as well as a sensor for sensing a turbine parameter and generating a sensor signal representative of said turbine parameter. The Examiner also acknowledged that Corsmeier lacks a modeling module generating a tip clearance prediction in response to turbine cycle parameters. The Examiner relied on Prowse, West and Haddad to obviate these deficiencies of the Corsmeier reference.

Applicants have carefully reviewed the passages from Corsmeier cited by the Examiner. Applicants respectfully submit that Corsmeier does not teach a controller that receives a sensor signal *and* a tip clearance prediction to generate at least one command signal for clearance control. The Examiner cited a passage at col. 8, lines 36-41. The cited passage reads as:

> A conventional rotor clearance sensor (not shown) can be used for sensing the actual rotor blade tip shroud clearance and sending the actual rotor blade tip shroud clearance and sending a signal to a control device which, in turn, activates an actuator to rotate the unison ring 78 for changing the clearance in the manner described earlier.
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> Corsmeier, col. 8, lines 36-41.

As can be seen from the cited passage, the control device activates the actuator based upon a sensed value of the actual rotor blade tip shroud clearance. Corsmeier does not even mention the control based upon sensed parameters such as temperature and pressure associated with the turbine. Further, Corsmeier does not teach the clearance control based upon a predicted tip clearance from a modeling module.

Further, the Examiner relied upon Prowse for disclosing a sensor for sensing a turbine parameter and generating a sensor signal representative of the turbine parameter. Applicants respectfully submit that Prowse teaches control of various valves in accordance with a predetermined program in response to the information supplied to a controller by temperature and pressure sensors. More specifically, the system is controlled to open or close or modulate the various valves in accordance with a predetermined program. It would not have been obvious to one of ordinary skill in the art at the time the invention was made to employ a sensor for sensing a parameter as taught by Prowse in a system for controlling blade tip clearance in a turbine of Corsmeier, because Corsmeier does not even teach clearance control based upon a sensed turbine parameter.

Furthermore, the Examiner argued that Haddad teaches a modeling module that generates a tip clearance prediction in response to a cycle parameter. Haddad teaches the use of a mathematic predictive model for estimation of transient response of the rotor tips and turbine case in order to provide an input parameter to the controller so as to maintain instantaneous radial clearance between the blade tips and shroud at a value which is no less than the required steady state clearance corresponding to the rotor speed. Applicants respectfully submit that Haddad teaches modulating the flow of cooling air for reducing the radial clearance between the rotating blade tips and a surrounding shroud based upon a current estimated clearance that is estimated based upon the engine operating parameters. This is rather a completely different solution from that claimed.

Applicants respectfully submit that it would not have been obvious to one of ordinary skill in the art at the time the invention was made to employ a modeling module for tip clearance prediction in response to the turbine cycle parameters as taught by Haddad in a system for controlling blade tip clearance in a turbine of Corsmeier. Furthermore, one of ordinary skill in the art at the time the invention was

made would not have even considered a sensed parameter in addition to the turbine cycle parameters employed by the mathematic predictive model described by Haddad for clearance control.

Applicants respectfully submit that Corsmeier does not each clearance control based upon a sensed turbine parameter or even a predicted tip clearance. Therefore, it would not have been obvious to one skilled in the art at the time the invention was made to clearance control to consider Prowse and Haddad to include the clearance control based upon a sensed turbine parameter *and* a tip clearance prediction in response to the turbine cycle parameters. Applicants submit that independent claim 1 is thus allowable, and respectfully request the Examiner to reconsider the rejection of the claim.

Claim 12 recites a method for controlling blade tip clearance in a turbine having a blade rotating within a shroud having a plurality of shroud segments. The method includes obtaining a turbine parameter, generating a tip clearance prediction in response to cycle parameters. The method also includes generating at least one command signal in response to the turbine parameter *and* the tip clerance prediction, and providing the command signal to an actuator to adjust a position of at least one of the shroud segments.

As discussed above with reference to claim 1, Corsmeier does not teach clearance control based upon a sensed turbine parameter or even a predicted tip clearance. Furthermore, it would not have been obvious to one skilled in the art at the time the invention was made to consider Prowse and Haddad to include the clearance control based upon a sensed turbine parameter *and* a tip clearance prediction in response to the turbine cycle parameters. Applicants submit that independent claim 12 is therefore allowable and respectfully request the Examiner to reconsider rejection of the claim.

With regard to dependent claims 2-9, 11 and 13-17, these claims depend directly or indirectly from allowable claims 1 and 12, and are therefore considered to be allowable at least by virtue of their dependency from an allowable base claim.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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Patrick S. Yoder
Reg. No. 37,479
FLETCHER YODER
P.O. Box 692289
Houston, TX 77269-2289
(281) 970-4545